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Identification of Brassicas by Seedling Growth or Later Vegetative Stages¹

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INTRODUCTION AND PROCEDURES

In a previous publication² it was shown how species of *Brassica* may be distinguished by their seed. During the several years of preparation of this bulletin seed identifications made in the laboratory were

¹ This circular supersedes a processed publication issued in 1941 by the Bureau, entitled, "The Identification of Brassicas by Seedling Growth."

² MUSIL, A. F. DISTINGUISHING THE SPECIES OF BRASSICA BY THEIR SEED. U. S. Dept. Agr. Misc. Pub. 643, 35 pp., illus. 1948.

verified by growing in the greenhouse and in the field. The present publication presents that part of the investigation. Because of the great number of horticultural varieties involved, especially in those crops cultivated for table use, only botanical varieties are included in this brief treatment.

Seeds of *Brassica* crops are so similar in appearance that a mistake in labeling or a mixture of kinds is difficult to detect except by a trained seed analyst, and an error in labeling may mean an expensive loss of crop. When laboratory services are not available for identifying the seed or if it is desirable for a laboratory to verify an identification, it is usually possible to identify the species and botanical variety in the seedling stages or early vegetative growth.

In closely related groups there may be individuals that cannot be identified with certainty, but it is believed that with experience a reliable evaluation of such samples can be made from the seedling growth. In cases where it was difficult to distinguish between annual and biennial forms of a species in the early stages of growth it was found that by providing additional light the stems of the annual variety elongate rapidly and run into flower in about 6 weeks. This difference in rate of growth is readily recognized, and it is usually not necessary to wait for the flowering stage to determine the kind.

As the plants must be carried along for a period of 2 to 6 weeks, a more normal growth results with the use of garden or potting soil instead of sterilized soil in the greenhouse flats, but care must be exercised to obtain soil that has not been contaminated with other *Brassica* seeds. The seedlings should be examined at frequent intervals as they make rapid growth. The color and leaf form may be markedly changed after an interval of a week or 10 days. The plants are highly sensitive to environmental conditions of moisture, temperature, and light. Competition for light in the greenhouse flat or a prolonged period of cloudy weather may alter their appearance considerably. Insufficient light is conducive to excessive elongation of the stem internodes in some species, while in other species the characteristic bluish color fails to develop normally. Until sufficient experience has been gained to recognize the plants under varying conditions and at various stages of growth, it is advisable to plant check samples of known identity for comparison.

The descriptions and illustrations that follow are based on 14-day seedlings that have been grown under ordinary greenhouse conditions during the fall and winter months, with a night-day temperature range of approximately 55° to 70° F. In most cases the first foliage leaves of the 14-day plants have been compared with leaves from the same plants at 6 weeks to show characteristic changes in the later leaf forms. When a longer photoperiod was required for early varietal determination, 4 hours of additional light were provided daily by 100-watt incandescent lamps spaced 3 feet apart and about 4 feet above the plants, 14 days after time of planting. Continuous all-night illumination increased the rate of growth somewhat, but it was not found to be necessary for making an early identification.

Until recent years this country depended almost entirely on foreign markets for its seed supply; consequently, the plants of this genus are not so well known as other crop plants. For convenient reference brief descriptions and illustrations of some of the later stages of growth are included.

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E R R A T U M

Please attach this note to page 2 in U. S. Department of Agriculture Circular 857, Identification of Brassicas by Seedling Growth or Later Vegetative Stages: The illustration appearing on page 20 should be above legend No. 8 on page 13; and the illustration on page 13 should be transferred to page 20.

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CLASSIFICATION OF THE PLANTS

The species of *Brassica* grown in this country, imported for processing, or occurring as field weeds fall into three major groups: (*a*) The rapes; (*b*) coles, or cabbage; and (*c*) the mustards. The botanical classification as used in the bulletin on the identification of the seeds³ has been followed in the present circular.

RAPE

Rape (*Brassica napus* L.) is characterized by foliage that is dark bluish green, glaucous,⁴ smooth, or with a few scattered hairs near the margins. As will be shown in the illustrations of the seedling plants, the leaves have the same general shape in all varieties of the species, but the shape of the terminal lobe and the number of segments may vary with the variety or to some extent among plants of the same variety. The inflorescence is an elongated raceme, the flowers large, clustered at the top but not prominently overtopping the terminal buds, often with open flowers along the axis below, as illustrated by winter rape in figure 1.

The rapes are represented in this country by four varieties: (*a*) Winter rape; (*b*) summer rape; (*c*) rutabaga; and (*d*) rape-kale. Winter rape, a biennial or winter annual, is planted for fall and winter pasture. The variety Dwarf Essex is planted almost exclusively so that the name is often used synonymously for winter rape. Summer rape, an annual producing comparatively little leafage, is essentially an oilseed crop. It is not in cultivation here, but it has been offered to the trade as a substitute for winter rape when seed of winter rape is scarce. Rutabaga is grown throughout the country, the young tops being used for greens and the tubers for both table use and stock feed. The rape-kales are not in cultivation here as a forage crop, but one variety, Dwarf Siberian kale, is planted for greens.

COLE, OR CABBAGE

With the exception of some of the kitchen kales, most of the cultivated forms of cole, or cabbage (*Brassica oleracea* L.), are characterized by foliage that is thick and somewhat leathery, glaucous, and smooth; the inflorescence an elongated raceme with large open flowers along the axis below the terminal buds much as in winter rape. There are many botanical and horticultural species in this group, but only a representative form of each of the more important botanical varieties will be included here.

MUSTARD

Several species comprise the mustard group. These include a variety of plants, the relationship of which is not always readily apparent. The plants may be annual or biennial, the foliage varying in shape and color from bright green and hairy to lightly glaucous and smooth. The species may be grouped roughly into three classes: (*a*) Turnip and allies; (*b*) the true mustards; and (*c*) oriental, or Chinese mustards.

³ See footnote 2.

⁴ Glaucous, covered with a bloom or whitish substance that rubs off.

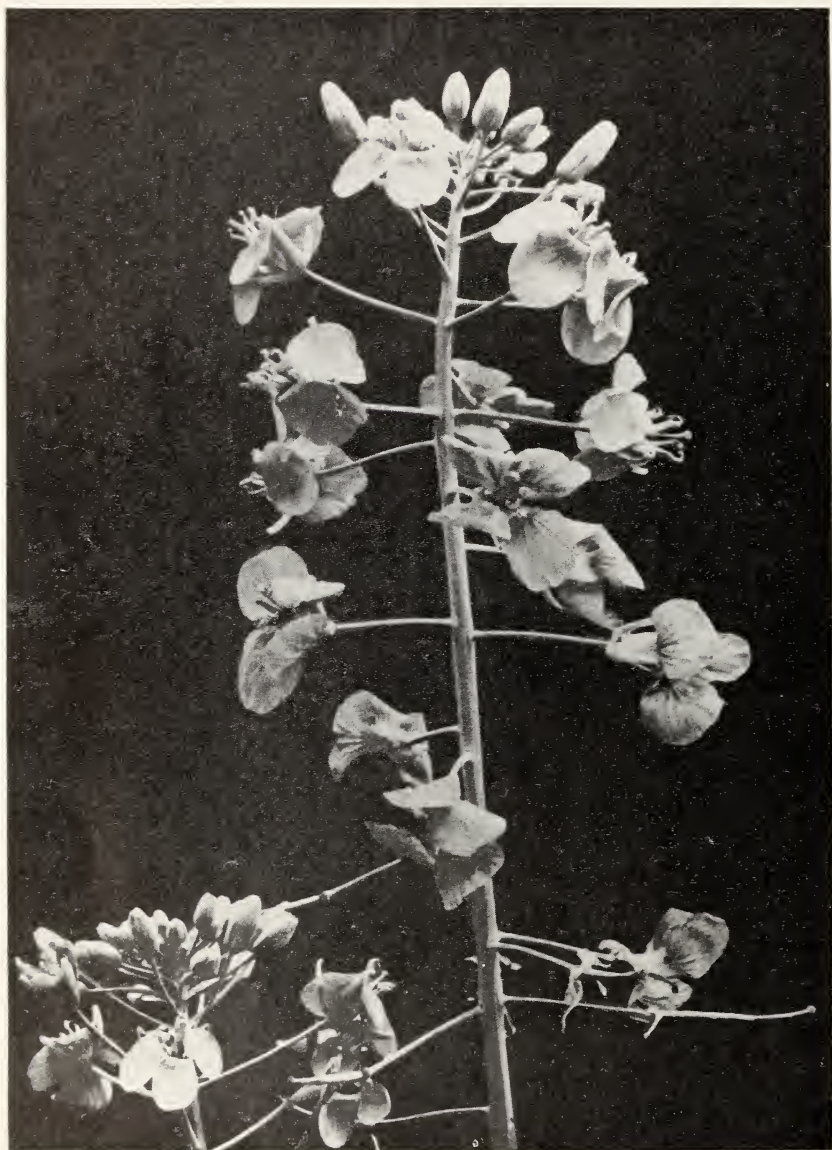


FIGURE 1.—Inflorescence of winter rape, showing the large flowers clustered at the top but not overtopping the terminal buds.

TURNIP AND ALLIES

The turnip group includes three types of plants: (*a*) The edible turnip; (*b*) the so-called wild turnip; and (*c*) turnip-rape, annual and biennial oilseed crops. With the exception of the strap-leaved, or Japanese turnips, the leaves are lyrate in form, bright green or lightly glaucous in the annual forms, sparingly to copiously hairy;

the flowers are small, clustered at the top of the raceme and usually overtopping the terminal buds, as shown in figure 2.

THE TRUE MUSTARDS

Four species are included in the true mustards: (a) Brown mustard, with several horticultural varieties; (b) black, or Trieste, mus-



FIGURE 2.—Inflorescence of turnip-rape, showing the small flowers clustered at the top of the raceme and overtopping the terminal buds.

tard; (c) white mustard; and (d) charlock, or wild mustard. These mustards are used chiefly in the manufacture of condiments, as table greens, and for planting as cover crops. Charlock is a widespread field weed and is sometimes screened in quantity out of grain. At present it is in limited use as a quick cover crop in situations where close cultivation is practiced. All four species are annuals and flower early. They are readily distinguished in early stages of growth and later by the character of the inflorescence and seed pods, or siliques, as shown in figures 3, 4, and 5.



FIGURE 3.—Inflorescence of (A) black mustard, showing oblong cluster of flowers at the top of the raceme and the small four-angled pods appressed to the axis below; and (B) charlock, with seed pods on short, stout pedicels more or less spreading away from the axis, the long beak angled and containing a single seed.



FIGURE 4.—Inflorescence of brown mustard (*A*) in early flowering stage and (*B*) in fruit, the flattened pods on long pedicels spreading away from the axis.

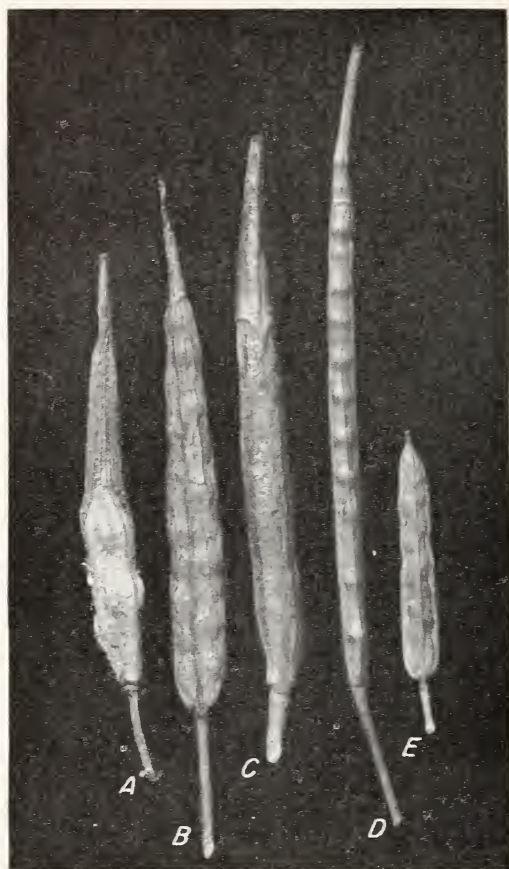


FIGURE 5.—Mature pods of five species of mustard, showing relative size and character of the beak: *A*, White mustard, pod hairy, with flat knifelike beak; *B*, brown mustard, pod flattened, beak comparatively short, pedicel long and slender; *C*, charlock, pod rounded, the four-angled stout beak usually containing a single seed, pedicel short and stout; *D*, Mediterranean wild turnip, pod long and slender, the beak containing one or two seeds; *E*, black mustard, pod sharply four-angled, beak short and slender. Approximately $\times \frac{1}{2}$.

ORIENTAL, OR CHINESE, MUSTARDS

There are numerous varieties of oriental mustards, some of which appear only sporadically on the market. At the present time four species are in general use: (*a*) Petsai, or Chinese cabbage; (*b*) spinach mustard, or Tendergreen; (*c*) Pakchoi, or white celery mustard; and (*d*) sarson. Sarson is not in cultivation here, but the seed is sometimes imported for crushing. Petsai, Pakchoi, and spinach mustard are popular as greens for table use.

DIAGNOSTIC FEATURES

The size of the cotyledons or seed leaves and to some degree the color and shape provide a clue to the species. The cotyledons are either large or relatively small, the color bluish green, bright green,

or yellow green. The chief distinctions, however, are to be found in the shape, color, and pubescence of the true leaves and the character of the first internode. The leaf should be fully expanded for the determination of shape and pubescence, as the emerging leaf may exhibit a somewhat different shape than the older leaf and may appear to be more hairy than is actually the case.

KEY TO THE SEEDLINGS

(14-day plants)

- a.* Cotyledons large ($\frac{5}{8}$ to $\frac{7}{8}$ inch across).
 - b.* First foliage leaves oblong or shield-shaped, thin, bluish green (thicker and dull bluish green in cabbage group), smooth or with a few hairs near the margins.
 - c.* Apical tooth markedly larger than the others; first internode distinct.
 - (1) Winter rape (fig. 6, *A*).
 - (2) Summer rape (fig. 6, *B*).
 - (3) Siberian kale (fig. 8, *B*).
 - (24) Sarson (fig. 16, *A*).
 - (5 to 13) Cabbage group (figs. 9 to 12).
 - cc.* Apical tooth only slightly larger than the others; internode not evident.
 - (4) Rutabaga (fig. 8, *A*).
 - ccc.* Apex rounded; margins serrate or entire; petioles long, white; no internode----- (23) Pakchoi (fig. 16, *C*).
 - bb.* First foliage leaves spatulate or strap-shaped; bright green, smooth.
 - c.* Leaf margins minutely serrate or entire.
 - (21) Spinach mustard (fig. 15, *B*).
 - cc.* Leaf margins coarsely serrate.
 - (17) Shogoin, or Japanese, turnip (fig. 15, *A*).
 - ccc.* Leaf margins uniformly indented (in common varieties).
 - (22) Petsai (fig. 16, *B*).
 - bbb.* First foliage leaves lyrate, hairy, bright green.
 - (27) White mustard (fig. 18, *B*).
- aa.* Cotyledons small ($\frac{1}{8}$ to $\frac{3}{8}$ inch across).
 - b.* First foliage leaves oblong, bright green, hairy, crepelike in texture.
 - c.* Margins irregularly and deeply incised.
 - (16) Common turnip (fig. 13, *C*).
 - (15) Biennial turnip-rape (fig. 13, *B*).
 - (20) Wild turnip (fig. 15, *C*).
 - cc.* Margins dentate----- (14) Annual turnip-rape (fig. 13, *A*).
 - bb.* First foliage leaves oblong, bright green to light bluish green, sparingly hairy, not crepelike in texture----- (14) Annual turnip-rape (fig. 13, *A*).
 - bbb.* First foliage leaves broadly oval, bright green, mostly smooth.
 - c.* Margins deeply incised----- (10) Kitchen kales (fig. 11, *A*).
 - cc.* Margins with few and shallow indentations.
 - (25) Brown mustard (fig. 17, *B*).
 - bbbb.* First foliage leaves spatulate, bright green; first internode long.
 - c.* Margins irregularly dentate or with only a few shallow indentations.
 - (26) Black mustard (fig. 17, *A*).
 - cc.* Margins more uniformly dentate, the indentations shallow; stem and petioles bristly hairy----- (28) Charlock (fig. 18, *A*).

DESCRIPTION OF SEEDLINGS

RAPE GROUP

I. WINTER RAPE, OR SWEDE RAPE

Cotyledons of winter rape (*Brassica napus* var. *biennis*) are large, bluish green; first foliage leaves oblong or shield-shaped; margins coarsely and irregularly toothed, the apical tooth conspicuously larger than the others (fig. 6, *A*). The leaves are smooth or with a

few scattered hairs near the margins on the upper side and on midrib below, so that the unfolded leaf may appear quite hairy. When grown in full light the young leaves early develop the glaucous appearance so characteristic of the mature leaves, but this may be lacking in plants grown in a prolonged period of cloudy weather. The first internode is evident at an early stage.

2. SUMMER RAPE

The individual seedlings of summer rape (*B. napus* var. *annua*) cannot be distinguished with certainty from winter rape in the early stages (fig. 6, *B*). However, the stem elongates much more rapidly than in the winter rape, and this distinction becomes apparent in about 3 weeks. During the short days of the year the addition of 3 or 4 hours of additional light daily hastens the stem growth, as shown in figure 7.

3. SIBERIAN KALE

Cotyledons and first leaf of Siberian kale (*B. napus* var. *pabularia*) resemble winter rape, from which plant it is doubtfully distinguished until about the fourth or fifth week. By this time the leaves begin to show a deeply incised terminal lobe, with coarsely toothed, undulate, or wavy margins (fig. 8, *B*).

4. RUTABAGA, OR SWEDE TURNIP

Cotyledons and first leaf of Siberia kale (*B. napus* var. *pabularia*) to winter rape; foliage leaves smooth or sparingly hairy along the margins on upper side and on nerves below; broadly oval; margins with shallow, somewhat rounded teeth, the apical tooth only slightly larger than the others (fig. 8, *A*). The newly unfolded leaf often appears oblong in shape, with a pronounced apical tooth that is very similar to winter rape, but the fully expanded leaf develops the characteristic rounded terminal lobe. The stem does not elongate as does that of winter rape, and it is only in occasional individuals that the first internode is evident. The older leaves are somewhat thinner than those of winter rape and lack the pronounced blue-green color of the rape.

CABBAGE GROUP

The cabbage group, as commonly represented in the trade, includes a variety of plants that may be roughly grouped into three divisions: (*a*) The head-forming races, cabbage and brussels sprouts (5 and 6); (*b*) the nonheading races producing only open foliage, kales and collards (7 to 10), or leafy stem-tubers, kohlrabi (11); and (*c*) the inflorescence races, broccoli and cauliflower (12 and 13).

Because of the similarity in the young plants of some of these varieties and the many horticultural varieties represented, it is considered advisable to plant check samples of the possible kinds involved. The general aspect of the groups of plants when viewed together is usually more reliable than a consideration of the individual seedlings. The foliage leaves are smooth and, with the exception of some of the kitchen kales, are blue green and glaucous. The principal

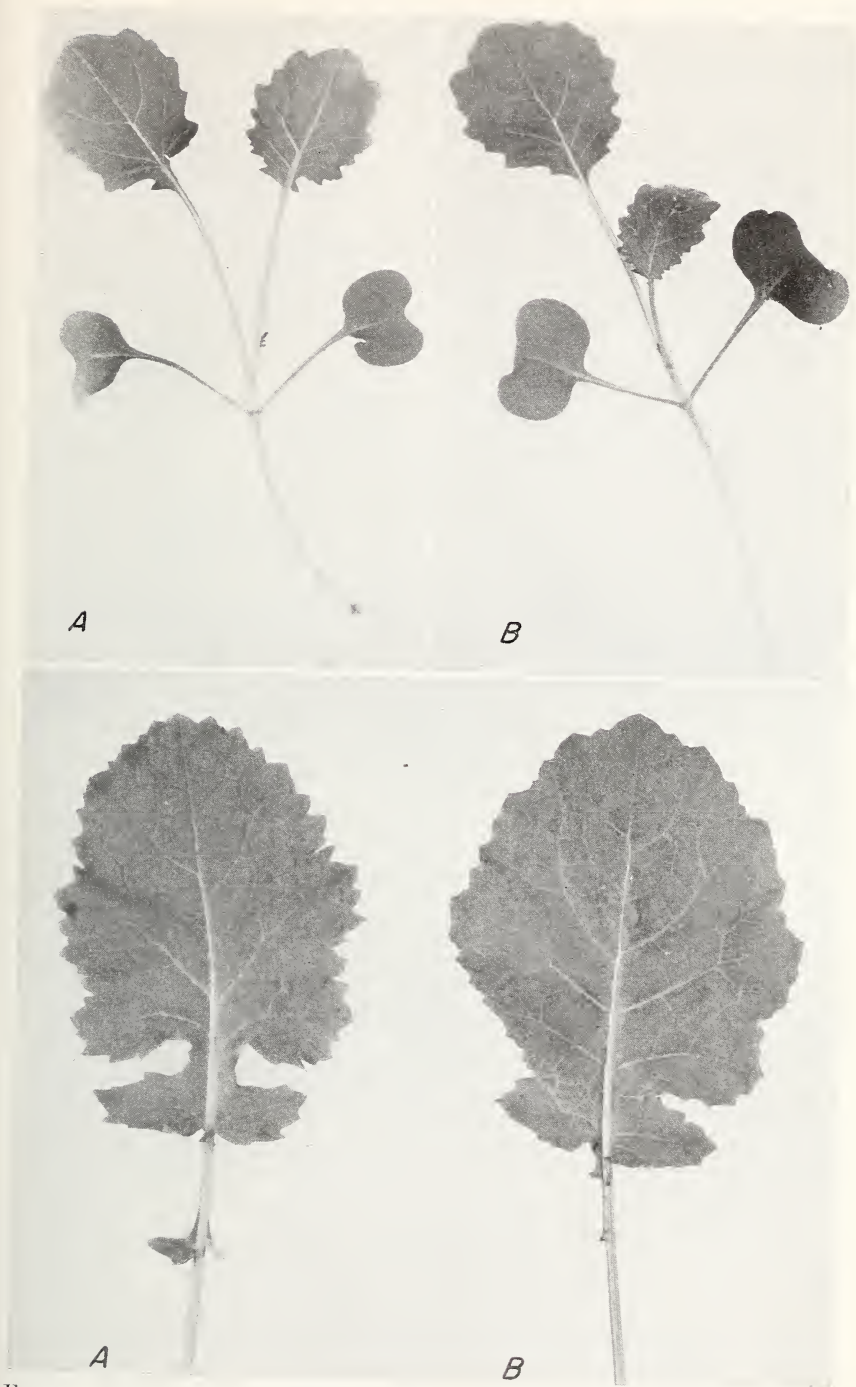


FIGURE 6.—Fourteen-day seedlings and leaves from plants at 6 weeks: A, Winter rape; B, summer rape. Approximately $\times \frac{1}{2}$.



FIGURE 7.—Six-weeks-old plants grown in greenhouse, February–March, with 4 hours of additional light supplied daily after the second week: *A*, Winter rape; *B*, summer rape.

distinctions may be found in the shape and texture of the first foliage leaves.

5. CABBAGE

There are many kinds of cabbage (*B. oleracea* var. *capitata*) on the market, but only the common plane-leaved form is considered here. The emerging first leaf is often bent out at right angles to the stem, a condition not observed in other varieties of the species. The cotyledons are large, blue green; the first foliage leaves are oblong or

rounded, with coarse marginal teeth, smooth, dull blue green, becoming glaucous and leathery. The later leaves are usually ovate in shape, with finely serrate margins, often with one or two small lobes at the base (fig. 9, A).

6. BRUSSELS SPROUTS

Cotyledons of brussels sprouts (*B. oleracea* var. *gemmifera*) resemble cabbage but slightly smaller; first foliage leaf rounded or shield-shaped, often with one or two rounded lobes near the base, margins indistinctly toothed; color as in cabbage. May be distinguished from cabbage chiefly by the smaller, rounded leaves and slower stem growth, as shown in figure 9, B.

7. CHINESE KALE

Cotyledons and foliage leaves of Chinese kale (*B. oleracea* var. *alboglabra*) resemble cabbage. The plant is an annual and runs into flower early. The rapidly elongating stem distinguishes it from cabbage. Not illustrated.

8. COLLARDS

Cotyledons and first foliage leaves of collards (*B. oleracea* var. *acephala*) have the same color and texture as cabbage, but the veining is usually more prominent. The first leaf is obovate or shield-shaped



FIGURE 8.—Fourteen-day seedlings and leaves from plants at 6 weeks: A, Rutabaga; B, Siberian kale. Approximately $\times \frac{1}{2}$.

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with irregularly toothed margins. Like cabbage, the older leaves become more evenly rounded in shape with finely toothed or serrate margins, often with two lobes at the base. Doubtfully distinct from cabbage in the early stages of growth (fig. 10, *A*).



FIGURE 9.—Fourteen-day seedlings and leaves from plants at 6 weeks: *A*, Cabbage; *B*, brussels sprouts. Approximately $\times \frac{1}{2}$.



FIGURE 10.—Fourteen-day seedlings and leaves from plants at 6 weeks: A, Collards; B, thousand-headed kale. Approximately $\times \frac{1}{2}$.

9. THOUSAND-HEADED KALE

Cotyledons of thousand-headed kale (*B. oleracea* var. *acephala*) resemble cabbage; the first foliage leaves oval to obovate with rather evenly toothed margins. The older leaves become more oblong in shape, sometimes with small lobes at the base (fig. 10, B).

10. SCOTCH CURLED KALE

The curled kales (*B. oleracea* var. *acephala*) are bright green to lightly blue green, not thick and leathery like cabbage. The first leaves are roughly oval in shape, with deeply and irregularly toothed margins. The later leaves show the familiar deeply curled or crisped margins and lobed base (fig. 11, *A*).

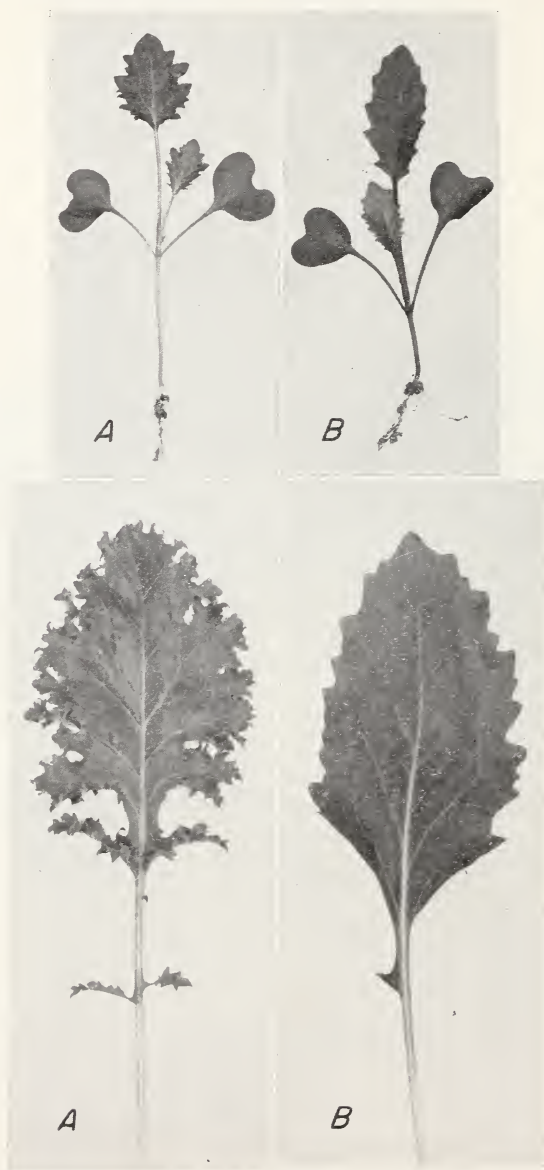


FIGURE 11.—Fourteen-day seedlings and leaves from plants at 6 weeks: *A*, Scotch curled kale; *B*, kohlrabi. Approximately $\times \frac{1}{2}$.

II. KOHLRABI

The first foliage leaves distinguish kohlrabi (*B. oleracea* var. *gongyloides*) before there is any evidence of a thickening of the stem. The leaves are long-petioled, smooth and glaucous, narrowly oblong with coarsely toothed margins. There is also a purple-leaved variety on the market (fig. 11, *B*).

12. CAULIFLOWER

The first leaf of cauliflower (*B. oleracea* var. *botrytis*) is elliptic in shape, with pointed apex and shallow, rounded teeth on the margins. Later leaves become narrowly oblong with rounded apex and serrate margins, and with one or two small lobes at the base (fig. 12, *A*).

13. BROCCOLI

The first foliage leaf of broccoli (*B. oleracea* var. *botrytis*) is shield-shaped, with marginal teeth few and irregular and usually with one or two pointed lobes at the base. Later leaves become more oval in shape, with shallow teeth and slightly undulate margins, the two pointed lobes at the base prominent. The rapidly elongating stem and bright blue-green color distinguishes it from cabbage (fig. 12, *B*).

MUSTARD GROUP

14. ANNUAL TURNIP-RAPE

(Bird Rape)

Cotyledons of annual turnip-rape (*B. campestris*) are small, $\frac{5}{16}$ to $\frac{9}{16}$ inch across, and bright green. First foliage leaves are bright green, smooth or with scattered hairs near the margins, roughly oblong in shape with coarsely toothed margins, usually not deeply lobed like turnip (fig. 13, *A*). In full light the leaves develop a bluish-green color, the stem elongates rapidly, and the plant runs into flower early, as shown in figure 14, *A*.

15. BIENNIAL TURNIP-RAPE

Cotyledons of biennial turnip-rape (*B. campestris* var. *biennis*) resemble annual turnip-rape. Foliage leaves are bright green, slightly wrinkled or crepelike in texture, with scattered bristly hairs on the upper surface and on nerves below. The leaves have a large, rounded terminal lobe with one or two small lobes below, the margins with coarse, irregular teeth, the petioles often hairy toward the base. The first foliage leaves usually do not have the lyrate form typical of the later leaves. There is no evident elongation of the internode (fig. 13, *B*).

16. TURNIP

Cotyledons and foliage leaves of turnip (*B. campestris* var. *rapa*) resemble biennial turnip-rape, and the individual plants of turnip and turnip-rape appear to be indistinguishable at an early stage (fig.

13, *C*). When viewed in mass the two varieties present a slightly different color aspect, turnip being lighter green, a distinction difficult to describe. Plants carried for a period of 6 weeks or longer, depending on the variety, will begin to show a thickening at the base of the stem, which is never present in biennial turnip-rape.

Seventop, one of the foliage turnips, is essentially the same as turnip

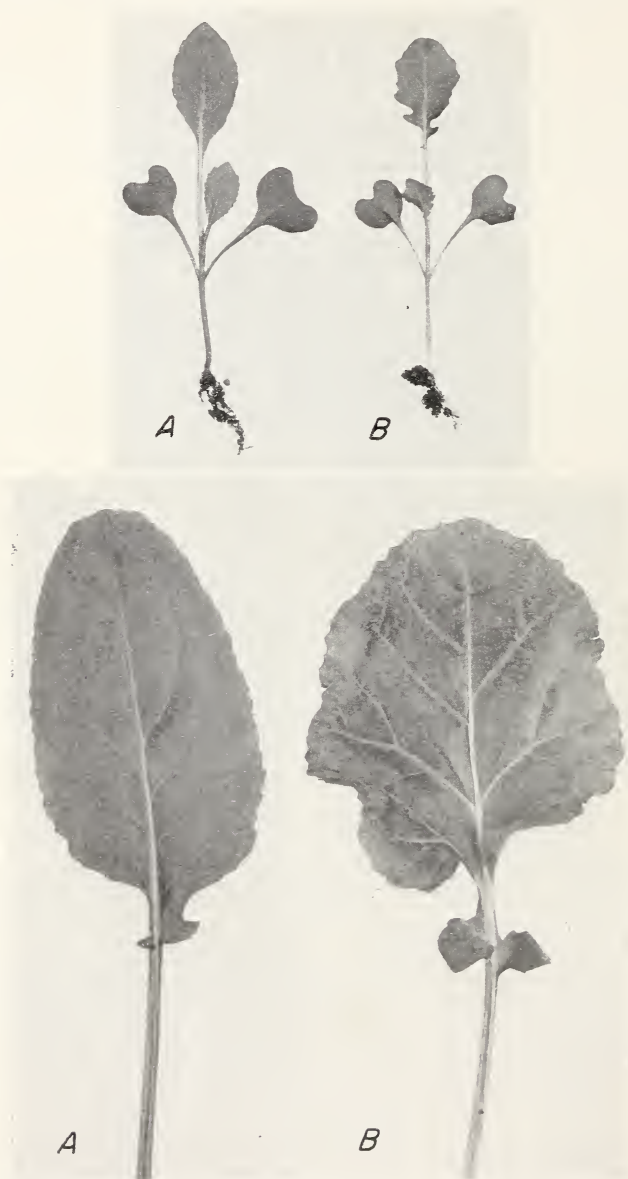


FIGURE 12.—Fourteen-day seedlings and leaves from plants at 6 weeks: *A*, Cauliflower; *B*, broccoli. Approximately $\times \frac{1}{2}$.



FIGURE 13.—Fourteen-day seedlings and leaves from plants at 6 weeks: A, Annual turnip-rape (bird rape); B, biennial turnip-rape; C, common turnip. Approximately $\times \frac{1}{2}$.

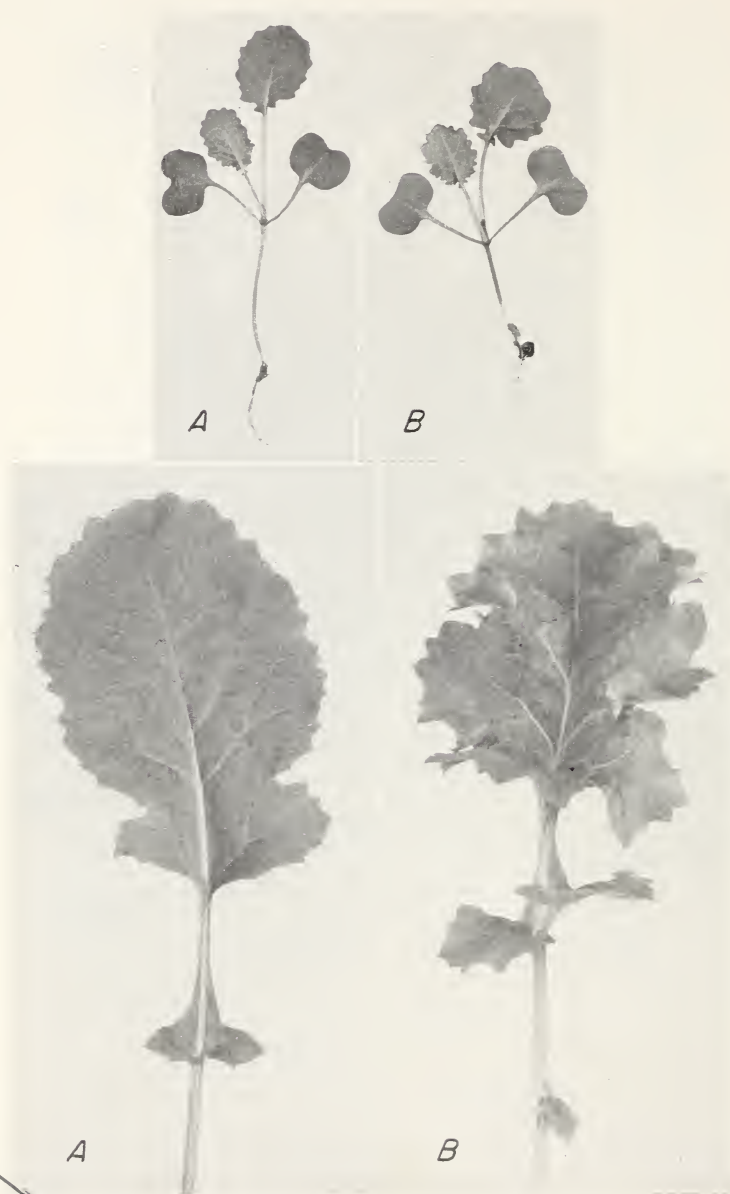


FIGURE 14.—Six-weeks-old plants grown in greenhouse, February-March, no additional light supplied. A, Annual turnip-rape (bird rape); B, biennial turnip-rape.

leaf
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 Fig. 14

and turnip-rape. In the absence of the thickened base it is doubtfully distinct from turnip-rape in the seedling stage.

17. SHOGGIN, OR JAPANESE, TURNIP

Cotyledons of Shogoin turnip (*B. campestris* var. *rapa*) are as large as in winter rape but bright green in color. Foliage leaves are spatulate or strap-shaped, either wholly without lobes or only very shallow ones, the blade tapering into a stout-winged petiole. The leaves are bright green, smooth, sometimes slightly leathery in texture, marginal teeth usually shallow and few (fig. 15, *A*).

18. FOLIAGE TURNIP

Cotyledons of foliage turnips (*B. campestris* var.) are the same as in turnip. Foliage leaves are bright green, hairy, oval or shield-shaped, with irregularly indented margins. The stem elongates rapidly and runs into flower early. Not illustrated; sometimes called "Broccoli rabe."

19. WILD TURNIP

This turnip (*B. campestris*) is believed to be a run-wild or degenerate form of garden turnip, from which it is doubtfully distinct in early seedling stages. Not illustrated.

20. MEDITERRANEAN WILD TURNIP

Cotyledons of Mediterranean wild turnips (*B. tournefortii*) are the smallest of the entire group. First foliage leaves are bright green, hairy, narrowly oblong with evenly toothed margins and a large apical tooth. Later leaves are long, slender, hairy, rather uniformly and deeply incised or cleft in lower half (fig. 15, *C*). Locally established as a weed on the west coast.

21. SPINACH MUSTARD, OR TENDERGREEN

Cotyledons of spinach mustard (*B. perviridis*) are large, similar to Shogoin turnip. Foliage leaves are bright, glossy green on both sides, smooth and delicate in texture, broadly obovate, tapering to a narrowly winged petiole, the margins entire or indistinctly toothed. No elongation of stem is evident in the early stages of growth (fig. 15, *B*).

22. PETAIS, OR CHINESE CABBAGE

There are several horticultural varieties of Petais (*B. pekinensis*), and the seedlings may show considerable variation in color and texture. The cotyledons are as large as in winter rape, yellow green in some of the common varieties, darker green in others. First foliage leaves are spatulate in shape, with coarsely toothed margins, stout white petioles and midribs, color varying with the variety from yellow green to dark green, smooth or with scattered bristly hairs along margins and on nerves below (fig. 16, *B*).



FIGURE 15.—Fourteen-day seedlings and leaves from plants at 6 weeks: *A*, Shogoin, or Japanese, turnip, $\times \frac{1}{2}$; *B*, spinach mustard, $\times \frac{1}{2}$; *C*, Mediterranean wild turnip, natural size.

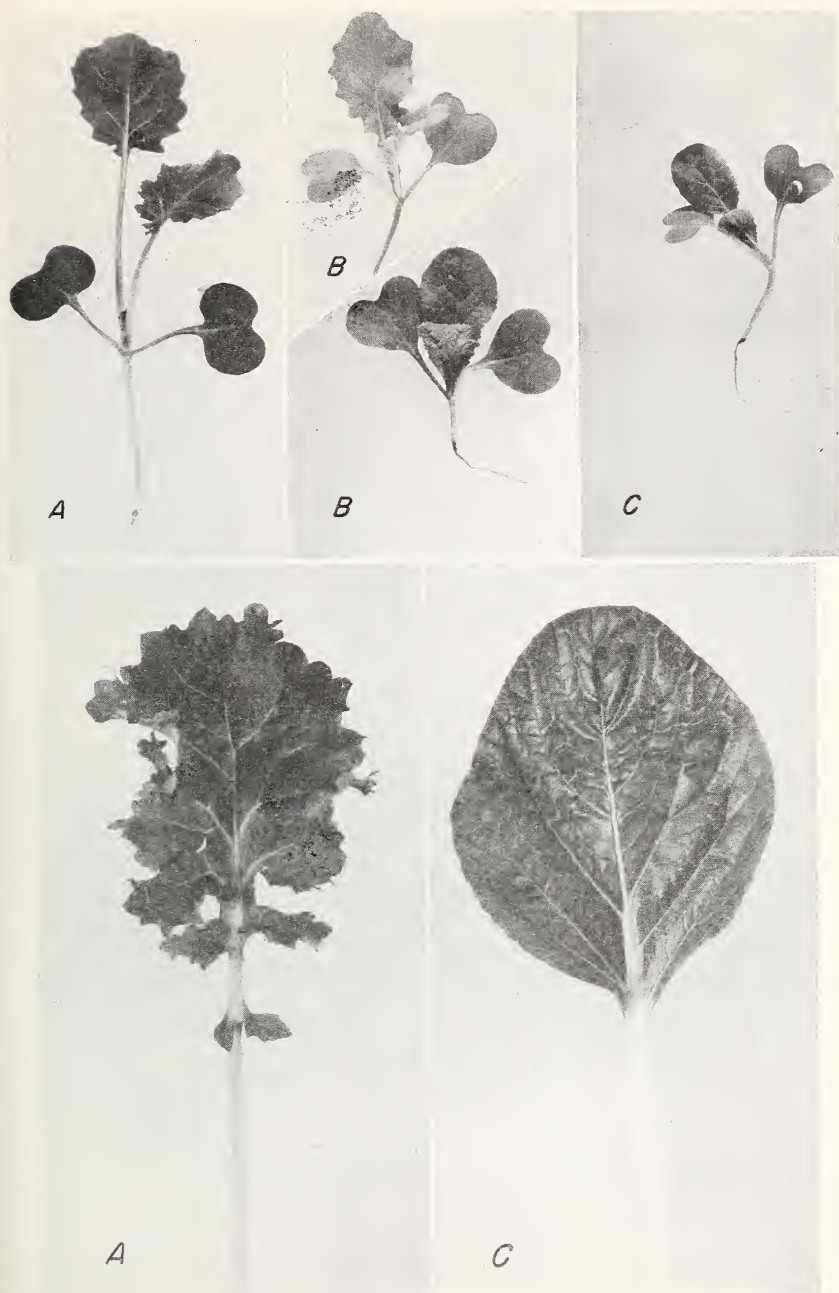


FIGURE 16.—Fourteen-day seedlings and leaves from plants at 6 weeks: *A*, Sarson; *B*, Petsai, or Chinese cabbage, two varieties; *C*, Pakchoi, or white celery mustard. Approximately $\times \frac{1}{2}$.

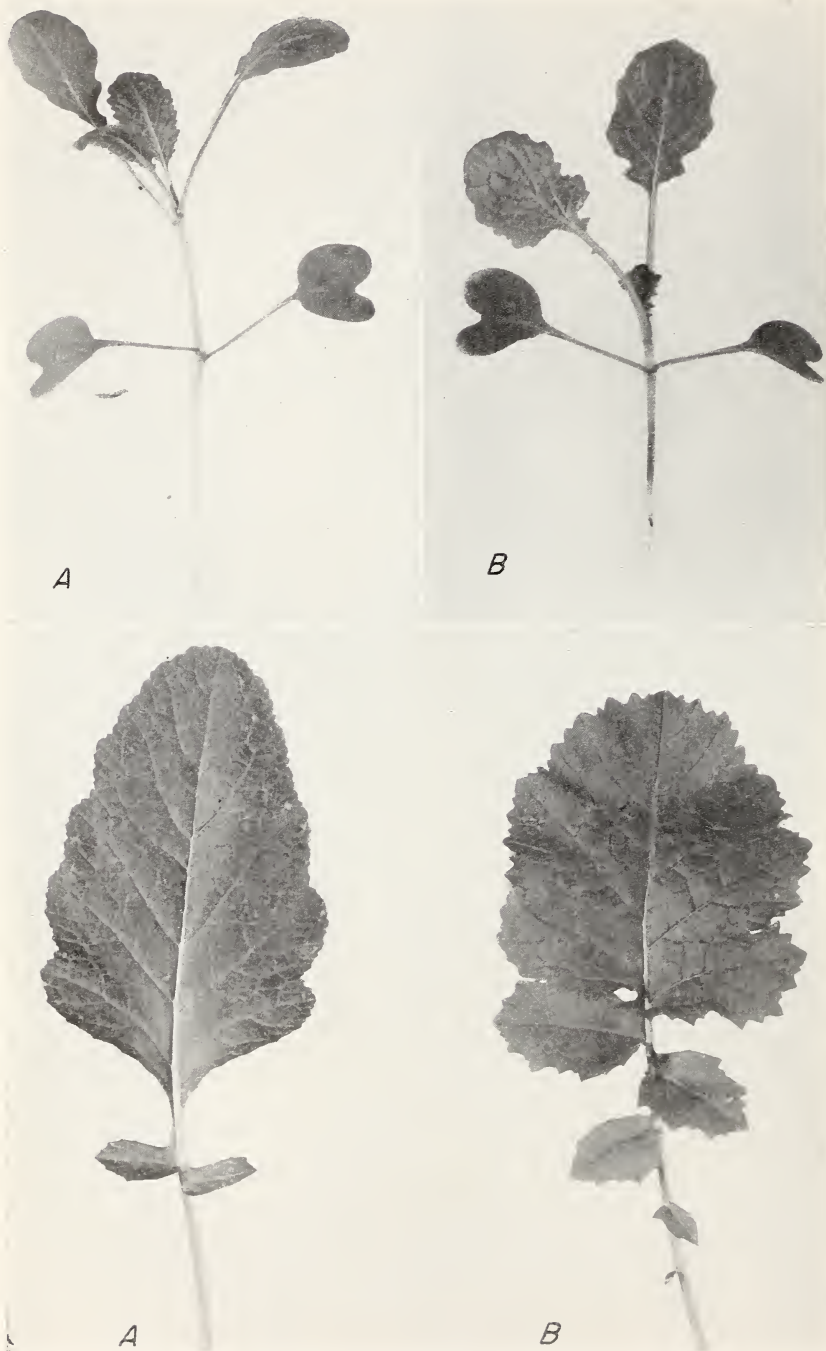


FIGURE 17.—Fourteen-day seedlings and leaves from plants at 6 weeks: A, Black mustard; B, brown mustard. Approximately $\times \frac{1}{2}$.

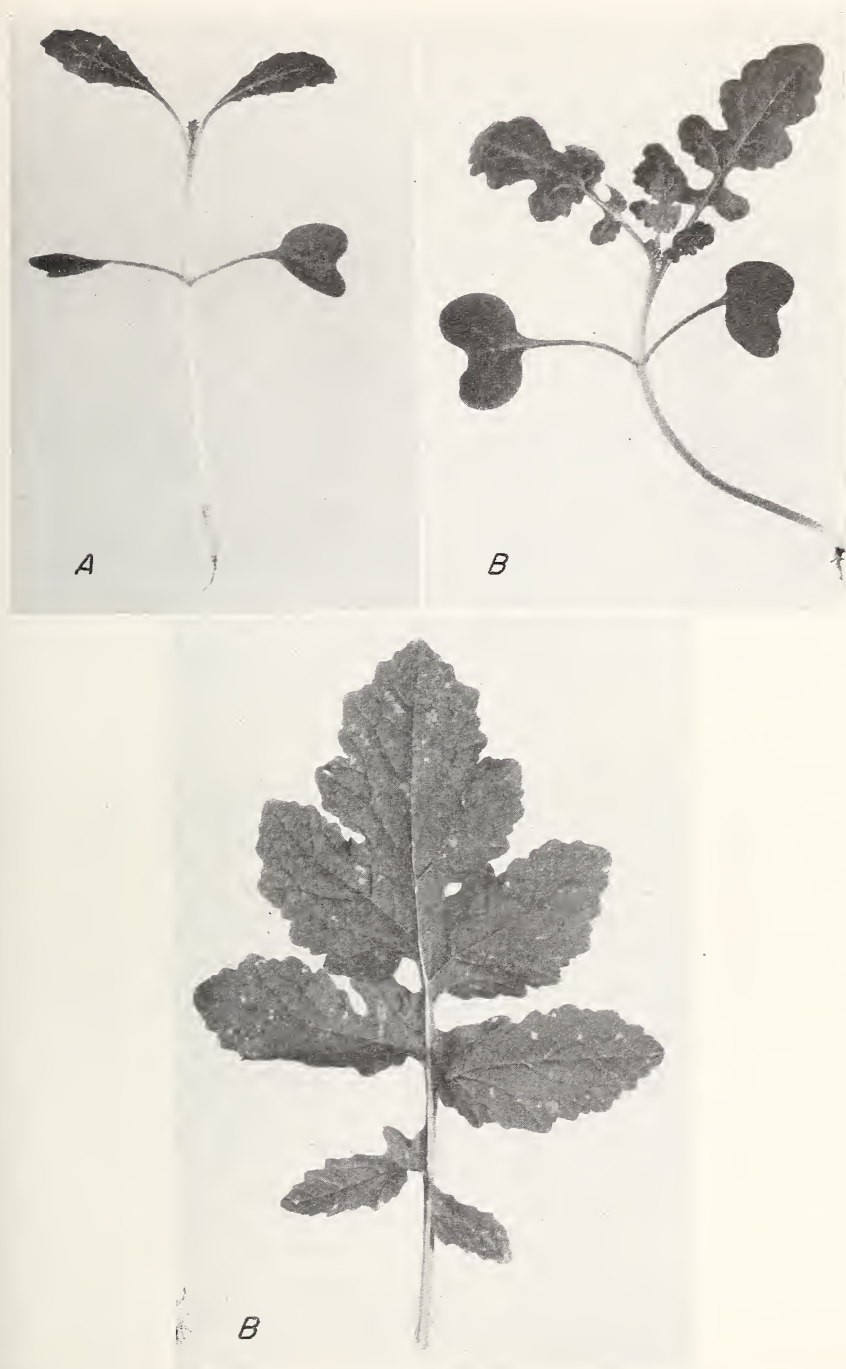


FIGURE 18.—Fourteen-day seedlings and leaves from plants at 6 weeks: *A*, Charlock; *B*, white mustard. Approximately $\times \frac{1}{2}$.

23. PAKCHOI, OR WHITE CELERY MUSTARD

Pakchoi (*B. chinensis*) is readily recognized by the long white petioles, the oval bright green, smooth leaf blades with entire or finely serrate margins. The plants quickly show tendency to develop the characteristic celerylike stalks. (Fig. 16, C.)

24. SARSON

Cotyledons and first foliage leaves of sarson (*B. campestris* var. *sarson*) resemble winter rape. Later leaves develop coarsely toothed, undulate margins that distinguish the plant from winter rape (fig. 16, A).

25. BROWN MUSTARD AND ORIENTAL MUSTARD

Foliage leaves of brown and oriental mustards (*B. juncea*) are broadly oval or oblong, bright green, smooth or with a few scattered hairs, margins with irregular shallow indentations; stem and petioles sparingly hairy (fig. 17, B).

26. BLACK, OR TRIESTE, MUSTARD

Foliage leaves of black mustard (*B. nigra*) are bright green, oblong or spatulate, smooth or with a few scattered hairs, the margins variously indented. Stem and petioles are sparingly hairy, the first internode (fig. 17, A) markedly longer than in brown mustard.

27. WHITE MUSTARD

Cotyledons of white mustard (*B. hirta*, formerly *B. alba*) are large. The first foliage leaves are bright green, lyrate, the margins with irregular rounded teeth, surface finely hairy. The stem and petioles are bristly hairy (fig. 18, B).

28. CHARLOCK, OR WILD MUSTARD

Cotyledons of charlock (*B. kaber*, formerly *B. arvensis*) are small. First foliage leaves are narrowly spatulate and rather uniformly toothed, the stem and petioles bristly hairy; first internode long (fig. 18, A).

